FONDATION
PRO VICTIMIS
GENÈVE

FEV 2013

SURVEY

EXISTING WATER ACCESS POINTS IN THE DISTRICTS OF BO, KOINADUGU AND TONKOLILI IN SIERRA LEONE

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ABSTRACT

An independent study conducted by a French NGO in Sierra Leone at the end of 2010 surveyed all existing water access points across three districts, documenting in detail the quality of the 2,859 structures identified. Only 30% of the structures in place were found to be capable of delivering access to safe water throughout the year.

Analysis of the results indicate that the low level of functionality reflects a supply-driven approach, a decrease in the quality of construction and an absence of attention to socio-organisational factors long known to be absolutely essential to the proper functioning of the systems. Given the critical importance of access to safe drinking water and the disparity between the stated intentions of donor organisations and the realities on the ground, the survey provides a telling picture that could be used as a basis for change and increased effectiveness.

I. INTRODUCTION

In terms of measuring access to safe drinking water, it is one thing to account for the number of improved drinking water systems which have been installed in developing countries. These numbers can be misleading, however, if the systems have been poorly built, built at the wrong time, or if the populations for whom they are intended are incapable of maintaining them in proper working order.

According to UN estimates, some 2.3 billion people suffer from diseases linked to unsafe water and about 60% of all infant mortality worldwide is linked to infectious and parasitic diseases, most of them water-related. Sierra Leone has the highest level of infant mortality in the world. According to the UK's Department for International Development, 283 children out of every 1,000 die before the age of five.[3] Along with acute respiratory diseases, waterborne and water-related diseases like diarrhoea and malaria are the most serious threats to public health in Sierra Leone.[4]

In Concerned about the lack of reliable, concrete information on the subject of access to safe drinking water, in 2010 Pro Victimis commissioned a survey of the quantity and quality of existing water access points in three districts in Sierra Leone. The survey was carried out by the Inter Aide, an independent French development NGO. It was conducted over a period of two and a half months between October and December 2010, with data analysis taking place during the first half of 2011. The survey area covered the districts of Bo (pop. 527,131), Tonkolili (pop. 370,425) and Koinadugu (pop. 265,765). A total of 37 chiefdoms containing three main towns and 2,907 villages and home to nearly 1,2 million people were visited. In terms of population, the survey represents 20% of the country's 5.5 million[5] people. In terms of geography, the three districts make up 34% of Sierra Leone.[6]

[1] Inter Aide is a French-based non-governmental organization founded in 1980 and working exclusively on concrete development projects mostly in rural environments. In Sierra Leone, it carries out projects in the area of water supply, agriculture and health.

[2] Established in 1988, the Pro Victimis Foundation is a private grant-making foundation that operates internationally to bring about lasting changes in the lives of the most disadvantaged and vulnerable communities in developing countries. To do this, it funds projects or programs implemented by non-governmental organizations, community-based organizations or social entrepreneurs which benefit those most in need.

[3] 2007 statistic.

[4] Africa Water Atlas, p. 267

[5] Overall population estimate based on 2012 CIA Factbook figures; district figures taken from 2008 census for Bo and Tonkilili and 2004 census for Koinadugu.

[6] Sierra Leone stretches over 71,740 km2, with the individual districts accounting for 5,500 km2 (Bo), 12,100 km2 (Koinadugu), and 7,000 km2 (Tonkilili).

II. METHODOLOGY

A protocol was developed and implemented for the purpose of the survey. It consists of eight stages as outlined below.

1. Inform concerned parties and collect relevant information:
The first stage was to discuss the planned surveys with the Ministry of Energy and Water Resources Water Supply Division heads and with the main organizations working in the area of water in the three target districts.

a) During the meeting with local authorities:

1. Inform them of the survey of water access points and request assistance from the villages.

2. Ask them for the list of NGOs currently working in each district and for those that were working there in the past.

3. Identify villages that have worked with outside agencies to further identify existing water access points.

b) Meet all the NGOs, both local and international, to collect all available information on water access points.

c) Work with the NGOs and/or local authorities and/or other stakeholders in order to plan the survey.

An e-mail was also sent to the main organisations in the rural areas of Sierra Leone to inform them that a survey was to be conducted in the three districts.

2. Meet key political figures:
Secondly, the 37 chiefdoms and three chief towns were visited in order to meet all the Paramount Chiefs. This step, indispensable in Sierra Leone, served to present the objectives of the survey to the heads of the chiefdoms and to promise to supply them with the survey results in the form of an inventory.

3. Identify surveyors:
During the visits, each of the Paramount Chiefs was asked to introduce its section heads[7] and potential surveyors who could reliably conduct the survey. Each of the surveyors received a moderate expense allowance and had to satisfy the following conditions:

1. volunteer for a period of at least 3 weeks;
2. be literate;
3. know the whole of the geographic zone;
4. be willing to pace all of the villages in the defined zone.

4. Train surveyors:
Surveyors were selected and given a two-day training course with one day dedicated to theoretical aspects of the work, and the other day covering practical field training. The theoretical day ensured that the surveyors understood the questionnaire and the field training gave them practice filling it out and the chance to familiarize themselves with the relevant equipment.

5. Plan survey:
Based on the list of villages provided by the section head, the section head together with the surveyor indicated the villages for which no safe water access point system existed and a schedule was then systematically drawn up for the visits to villages with access to water. Villages with no known system were not visited; data indicating the absence of a system is not based on direct observation. Nevertheless, this information was cross-checked during the course of the survey and is considered highly reliable.

6. Collect data:
Eighty-seven surveyors collected the information, with an average of three sections covered by each surveyor. Table 1 contains the parameters that were established for the systematic collection of data in villages with access to water.

[7] Overall population estimate based on 2012 CIA Factbook figures; district figures taken from 2008 census for Bo and Tonkilili and 2004 census for Koinadugu.

Interview – observation	Data collected	Comment
Data collected by interviewing the local players at the level of each village surveyed	Population	Population statistics associated with the survey are those given by the local population and are general indicators only. To be considered reliable for further use, they should be cross-checked with official census data. In practice, these figures will have a tendency to be inflated.
	Date of construction of the structure	Often confirmed by reading the notice on the structure.
	Organization that built the structure	
	Seasonality and number of months' drying out per year	The survey was carried out at the end of the rainy season during which time the water table is high.
	Number of maintenance operations carried out	
	Date of last maintenance operation	
	If the system is not functional, for how many months has this been the case?	
	Presence of a committee*	The surveyors were instructed to examine the management criteria (see below) in greater depth in the event of a positive reply, e.g., by meeting a member of the committee, finding out how much money is in the till, who is the pump caretaker, etc.
	Pump Care Taker*	
	Collection of money*	
	Availability of spare parts and tools for regular maintenance*	
Observed data	Type of structure	Borehole or hand-dug well
	For wells: open or not	Existence of a cover over the well
	Quality of the inside of the well	An empty square indicates the absence of an inspection cover to gain access to the inside of the well. Otherwise a rating of 1 to 4 was given depending on the condition of the inside of the well
	Quality of the outside of the well	A rating of 1 to 4 for the quality of the outside of the structure
	Type of pump	India Mark 2, Kardia, Inkar, PB Mark, Afridev and others
	Operation of the pump	Assessment of the operation of the pump. If there is no water (seasonality problem), the functioning of the pump was assessed with the community.

Table 1: Survey protocol: parameters for collection of data

*View management criteria (page 5)

7. Field supervision, data validation and entry:
A team of five people from Inter Aide, made up of one project manager and four supervisors, coordinated and supervised all surveyors in the field and validated all data entries. In the process, they covered over 15,000 kms on motorcycle and 5,000 kms by car. Table 2 reproduces the Excel form for entering the data, which was carried out by a dedicated individual working with the person in charge of supervising the zone concerned. All the data were then re-checked. After collection and verification of the data, very few entries (less than 20 out of nearly 4,500) showed inconsistencies. These were excluded from the results.

8. Share results in areas surveyed:
Results of the survey were shared with the local population via follow-up meetings with the chiefdoms, and to the relevant local institutions in the three districts.

	Surveyor							Chiefdom																	
	Date							section																	
						Well status					Well seasonnality		Well type		Hand pump					Water point management					
	Village	Population	Date of constrution	Organization	Funder	Inside	Outside	Protected	Open	Unfinished	Always dry	number of months dry	Bore Hole	Hand Dug	Type	working	Not working, how long	Number of reparation	Date of last reparation	water committee presence	fees collectionfor maintenance	presence of active pump carectakers	last maintenance done / number of months	spare parts & tools availability
1																									
2																									
3																									

Table 2: data entry format

Note on management criteria

In order to mitigate wear and tear of certain pump parts which may gradually lead to the complete failure of the system, all the manual pumping systems have to be maintained and, ideally, should receive preventive maintenance. Conducting a biennial or annual review and maintaining the structure help limit the risk that the parts may become impaired or break.

The community is responsible for maintenance and repair operations. In order to assess the accompanying measures put in place by the different operators and the impact that those measures had at the time of the survey, four management criteria were defined:

- the presence of a users' committee;
- the presence of a pump care taker (PCT) having the necessary skills to carry out the preventive maintenance operations and minor repairs;
- the organization of money collection to cover the expenses for maintenance operations (spare parts, transport, labour);
- the availability of tools and spare parts for day-to-day maintenance.

The surveyors were instructed to pay strict attention to these four indicators so as to make sure of the validity of the respondent’s statement. In the event of a positive reply, they were to ask to meet the committee members and the pump care taker, to ask about the amounts collected and to verify the amounts available in the till as well as to inspect the spare parts and tools.

III. RESULTS

Comprehensive data collected during the survey can be found on :
http://www.interaide.org/pratiques/node/451

DATA HIGHLIGHTS

1. OVERVIEW

In all, a total of 2,859 drinking water access systems were identified and visited.

- Rural: more than half (55% or 1,604) of the villages surveyed had no drinking water access point.
- Rural: In the 1,303 villages with drinking water access points, there were 2,652 structures, or 93% of all systems surveyed, serving an estimated population of 880,000.
- Rural: In villages with access points, 57% had one system; 24% of the villages had 2-4 systems; 8% of the villages had 5-24 systems.
- Urban: in the tree main towns of the districts, wells in private dwellings or compounds were not included in the survey. In terms of public access, 207 collective drinking water points were found, or 7% of all identified systems, serving an estimated population of 300,000.
    - Of these: 125 systems were in Bo town (pop. 215,474), Bo; 45 systems in Magburaka (pop. 66,313), Tonkilili; and 37 systems in Kabala (pop. 18,770), Koinadugu.

2. SYSTEM TYPES

Four types of structures were identified:
hand dug wells (2,028 structures, 71% of the total); boreholes (499 structures, 17% of the total); open wells with rope or pulley systems (330 structures, 12% of the total); and 2 spring boxes.

Basic technical features of these systems are outlined in the annex.

Types of structures surveyed:

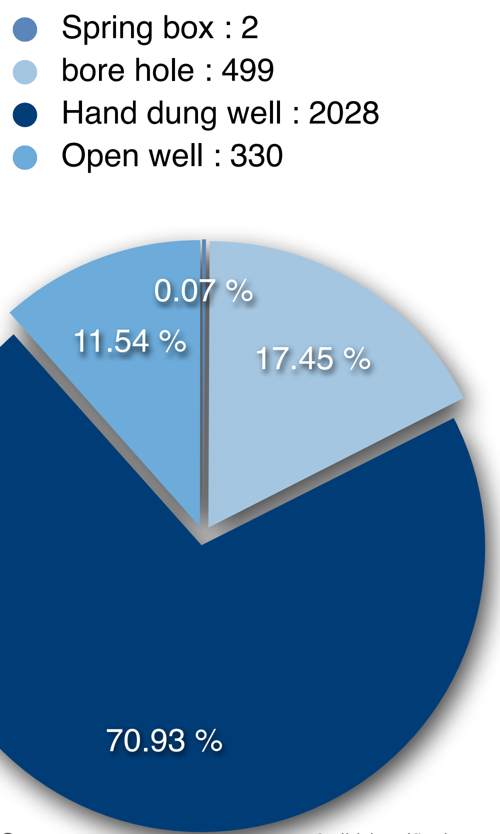

Figure 3 : System types as percentage of all identified water access point structures

3. SYSTEM PERFORMANCE

a) Open wells with rope or pulleys:

Open wells, which make up 12% of the water access points found in the three districts, have no protection against sources of contamination and are therefore not regarded as suitable for guaranteeing safe drinking water in the long term.

b) Unfinished:

6.4% of the structures (183 systems) were started but never completed.

Of these, 171 were hand-dug wells (8.4% of all hand dug wells), 11 were boreholes (2% of all boreholes) and 1 was an open well.

95% of the abandoned construction sites are in a rural environment.

c) Incomplete:

Of the 2,345 finished systems of boreholes and hand dug wells, 73 hand dug wells (3.5% of all hand dug wells) and 5 boreholes (1% of all boreholes) were not equipped with a pump at the time of the visit, so were incomplete.

d) Not functioning:

Of the finished, complete borehole and hand dug well systems surveyed (2,267), 669 (30% of finished, completed systems) were non-functional due to a broken pump.

e) Seasonality:

Water access point systems capable of delivering safe drinking water that were identified throughout the three districts totalled 1,598 structures or 56% of all structures identified. Of these, approximately half (866 structures) provide water permanently throughout the year. The other half are subject to drying out for varying monthly periods during the dry season.

Of all the water access point structures identified in the three districts, 56% were capable of delivering safe drinking water and 30% were capable of delivering safe drinking water throughout the year.

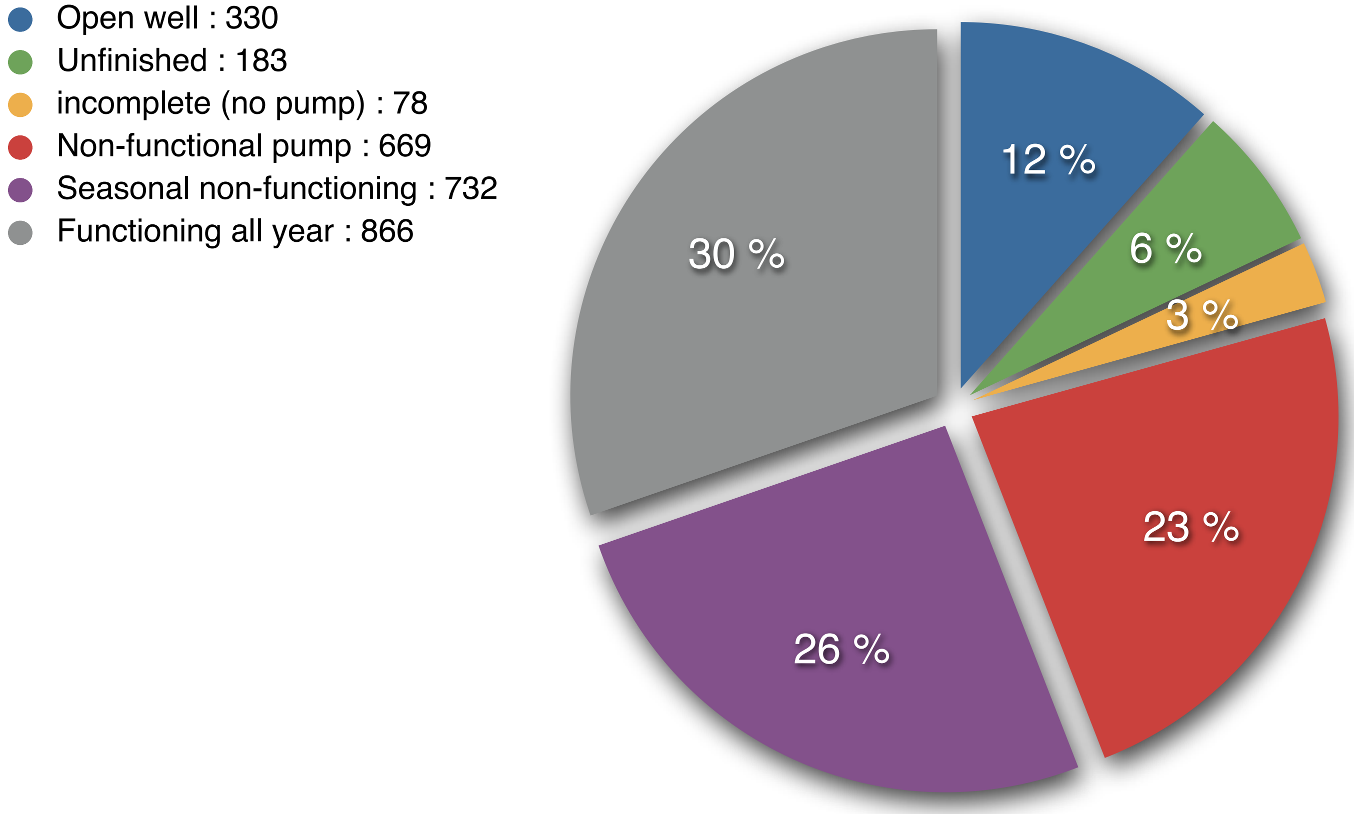

Figure 4: Overview of status of all structures surveyed

4. GEOGRAPHIC DISTRIBUTION

The tables below indicate the location of the identified drinking water access structures.

Of note, Bo town, which is the second-largest city in Sierra Leone, accounts for 60% of the structures in urban settings over the three districts.

Tonkolili has most of the open wells (62% of all open wells) and they account for 23% of Tonkolili's water access points.

Important variations in coverage were observed within the districts. For example, in the district of Koinadugu, 12% of the chiefdom of Neya's villages have a drinking water access system while in the chiefdom of Sengbeh 86% of the villages have a system.

Figure 5 : Map of Sierra Leone with highlighted districts of Bo, Tonkolili and Koinadugu

(Rural and urban)

District	**Bo**			**Koinadubu**			**Tonkolili**		
	Rural	Bo(town)	Total	Rural	Kabala	Total	Rural	Magburaka	Total
Total structures	1064	125	1189	752	37	789	836	45	881
Percentage of total	37 %	4 %	42 %	26 %	1 %	27 %	29 %	2 %	31 %

Table 6: Location of all water access point structures by district with urban and rural breakdown

(Rural only)

District	**Bo**	**Koinadugu**	**Tonkolili**
Chiefdoms	15	11	11
Sections	93	82	81
Villages surveyed	961	859	1087
Villages with at least one system	527	300	476
	55%	35%	44%
Bore hole	390 (37%)	5 (1%)	79 (9%)
Hand-dug well	656 (62%)	649 (86%)	567 (68%)
Open wells	18 (2%)	96 (13%)	190 (23%)
Spring box	0	2	0
Total system	**1064**	**752**	**836**

Table 7: Location of systems by type for rural areas in all three districts

Regarding location and functionality, the rate of functionality, defined as access to water throughout the year and a working pump, was uniformly low in all zones for hand dug wells. The district of Bo has a greater number of boreholes and better rates of functionality and seasonality than the other two districts.

(Rural only)

	Boreholes			Hand-dug wells		
District	**Total**	**Functional**		**Total**	**Functional**	
Bo	390	274	70%	656	232	**35%**
Koinadugu	5	0	0%	649	139	**21%**
Tonkolili	79	43	54%	567	118	**21%**
Total	**474**	**317**	**67%**	**1872**	**489**	**26%**

Table 8: Functionality per district for boreholes and hand dug wells in rural areas

5. MAINTENANCE CAPACITY

Four criteria were articulated to determine the community's long-term capacity to maintain the water access point systems. These are the:

1. presence of a users' committee;
2. presence of a local pump caretaker;
3. collection of money for maintenance of the structure;
4. possession of spare parts and tools to carry out maintenance operations.

For all completed boreholes and hand dug wells equipped with a pump, both functioning and not functioning on the day of the survey, the presence or absence of the four management criteria were recorded. The results reveal low levels for the collection of maintenance fees and the possession of tools and spare parts throughout the three districts.

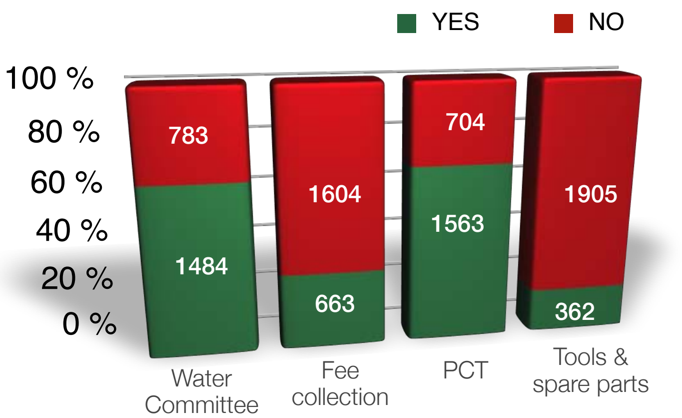

Figure 9: Presence or absence of management criteria for boreholes and hand dug wells

A comparison of the proportion of functional pumps relative to the four management criteria shows a clear positive correlation between functionality and fulfilment of management criteria.

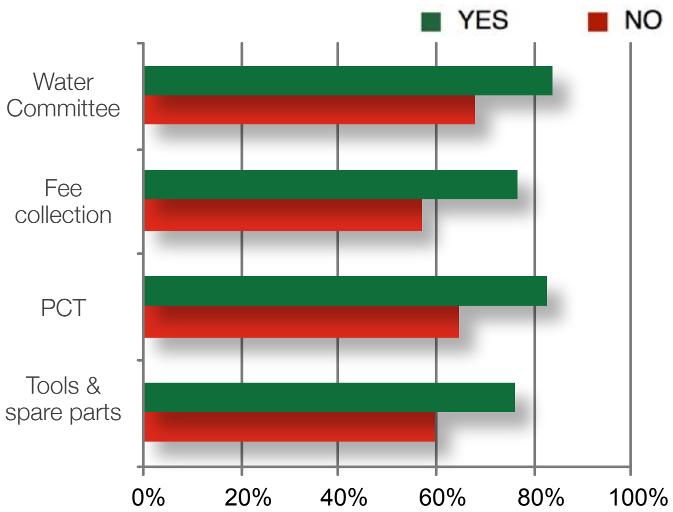

Figure 10: Proportion of functional pumps as a function of management criteria

6. PUMP TYPES

For all systems providing access to safe drinking water, the pump is a critical factor in functionality. At the time of the survey, 26% of systems were non-functional due to the absence of a pump or the fact that it was in need of repair.

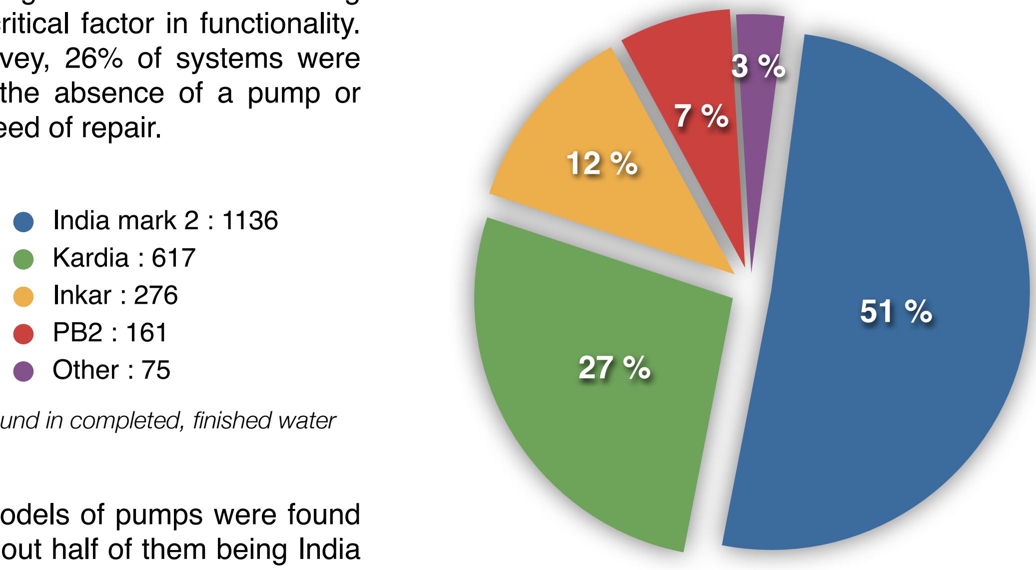

Figure 11: Types of pumps found in completed, finished water access point systems

A variety of different models of pumps were found in the systems, with about half of them being India Mark 2, approximately a quarter being Kardias, and the other quarter consisting of various types. Specific features of the different pump brands are outlined in Table 12.

Basic characteristics of pumps in use in Sierra Leone	
India Mark 2	- Purchase price between € 350.- and € 400.- (Freetown) - Installation relatively simple but requires compliance with some fundamental rules (length of the rods, positioning of the cylinder, right-hand level of the pump, etc) - Regular maintenance absolutely essential - Spare parts sometimes difficult to find and of variable quality - Supplier: Centrum International
Kardia	- Purchase price approximately €2000 (Freetown) - A robust pump, requiring relatively little but very expensive maintenance - Spare parts extremely difficult to find and very expensive - Supplier: Cardinal Investment
Inkar	- Pump quite similar to the Kardia and priced at approximately €1600 - Less present on the ground - Spare parts virtually impossible to find - Supplier: Cardinal Investment
PB Mark	- Purchase price approximately €1000 - Intermediate quality between the Kardia and the IM2 - The spare parts are all similar to the IM2 (except for the cylinder, which is virtually impossible to find locally) - No authorized supplier

Table 12: Overview of basic characteristics of different kinds of pumps in use in the three districts

7. TRENDS

Trends in type, completion, location, pump choice, maintenance capacity and functionality over time.

To observe patterns relative to the time of construction of the various systems in place, the results were grouped together to reflect three key contemporary periods:

- prior to 1991 when civil war broke out;
- 1992-2002 which corresponds to the conflict period;
- 2003-2010 which covers the post-conflict timeframe.

Overall, the majority of the systems in place (64%) were constructed during the post-conflict period. For a small number of systems, the construction date could not be determined.

Prior to 1991, boreholes made up 60% of the water access point systems found. For the most recent period, the choice of boreholes has dropped significantly, now representing only 8% of all recently built water access points.

Period	Bore hole		Hand-dug well		Open wells		Total	
until 1991	297	60%	258	13%	60	18%	615	22%
1992-2002	44	9%	287	14%	67	20%	398	14%
2003-2010	155	31%	1473	73%	202	61%	1830	64%
No Data	3	1%	10	0%	1	0%	14	0%
Total	499		2028		330		2857	

Table 13: Trends in types of structures built over time: prior to, during, and post civil war conflict

The vast majority of uncompleted sites (84%) is greater <u>after</u> 2003 than before or during the civil war.

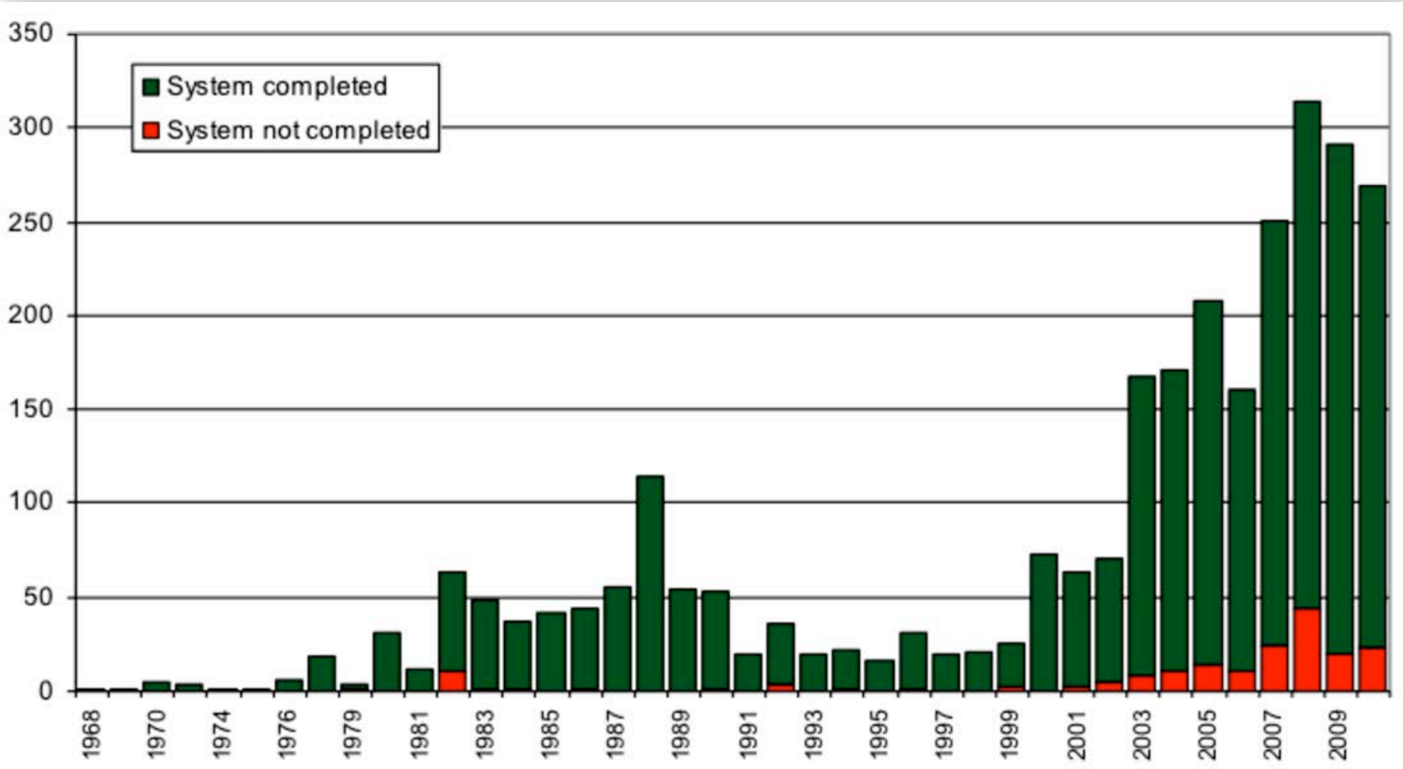

Figure 14: Number of systems completed and unfinished per year

During the period preceding the conflict, most of the water access point structures (91%) were concentrated in the two districts of Bo and Koinadugu.

During the war, there was a 10% rise in the number of structures built in urban settings which tapered off after the conflict. After 2003, there was a relatively proportional amount of structures built among the three districts.

Even though two-thirds of the boreholes are equipped with Kardia pumps and more than half (57%) of the hand-dug wells use India Mark2 pumps, the survey revealed a very wide variety of pumps in use in the three districts with no standard present. Trends in the choice of pumps over time show:

- A steady decline in the use of Kardia pumps from the early 1990s to the present (accounting for 60% of pumps during the pre-war period as compared with 15% after 2003);
- A marked increase in the use of India Marks over the same time period (22% until 1991 compared with 64% post 2003);
- An increase in the use of Inkar and PB2 pumps during the conflict with a drop in their numbers after 2003.

Period	India Mark 2		Inkar		Kardia		Other		PB2		Total
until 1991	118	22%	33	6%	319	60%	10	2%	48	9%	528
1992-2002	117	38%	72	23%	76	24%	8	3%	38	12%	311
2003-2010	914	64%	168	12%	219	15%	57	4%	74	5%	1434
ND	1	9%	3	27%	5	45%	1	9%	1	9%	11
Total	**1150**	**50%**	**276**	**12%**	**619**	**27%**	**76**	**3%**	**161**	**7%**	**2282**

Table 15: Trends in pump choice over time: prior to, during and post civil war conflict

With regard to the absence or presence of the four **management criteria**, a consistent decrease in the presence of all four criteria over time was observed.

The table reflects the existence of each of the management criteria at the time of the survey as reported for structures built per period.

Management Criteria	Pre-1991	Post 2002
Existence of a Users' Committee	(377/526) 72%	(909/1420) 64%
Presence of a pump caretaker	(395/526) 75%	(936/1420) 66%
Presence of fees	(227/526) 43%	(366/1420) 26%
Presence of spare parts	(156/526) 30%	(164/1420) 12%

Table 16: Comparison of management criteria before and after the civil war

When looking at the percentage of **systems functioning** per year of construction on the day of the survey (Table 17 below), a marked decrease in functionality occurs shortly after the period of conflict begins.

Surprisingly, functionality only increases very slightly after the war ends which is all the more unusual since this corresponds to the most recently built structures. Systems installed from 2003 through 2009 varied between 17% and 40% functionality. So seven years post conflict, in 2009, only 40% of the systems built were operational one year later. By contrast, 73% of the 22-year old structures – those built in 1988 – were in working condition.

8. Providers

Some 126 different organizations financed and built the structures surveyed.

Twenty-five organisations are responsible for building 20 systems or more, accounting for nearly 80% of the existing structures.

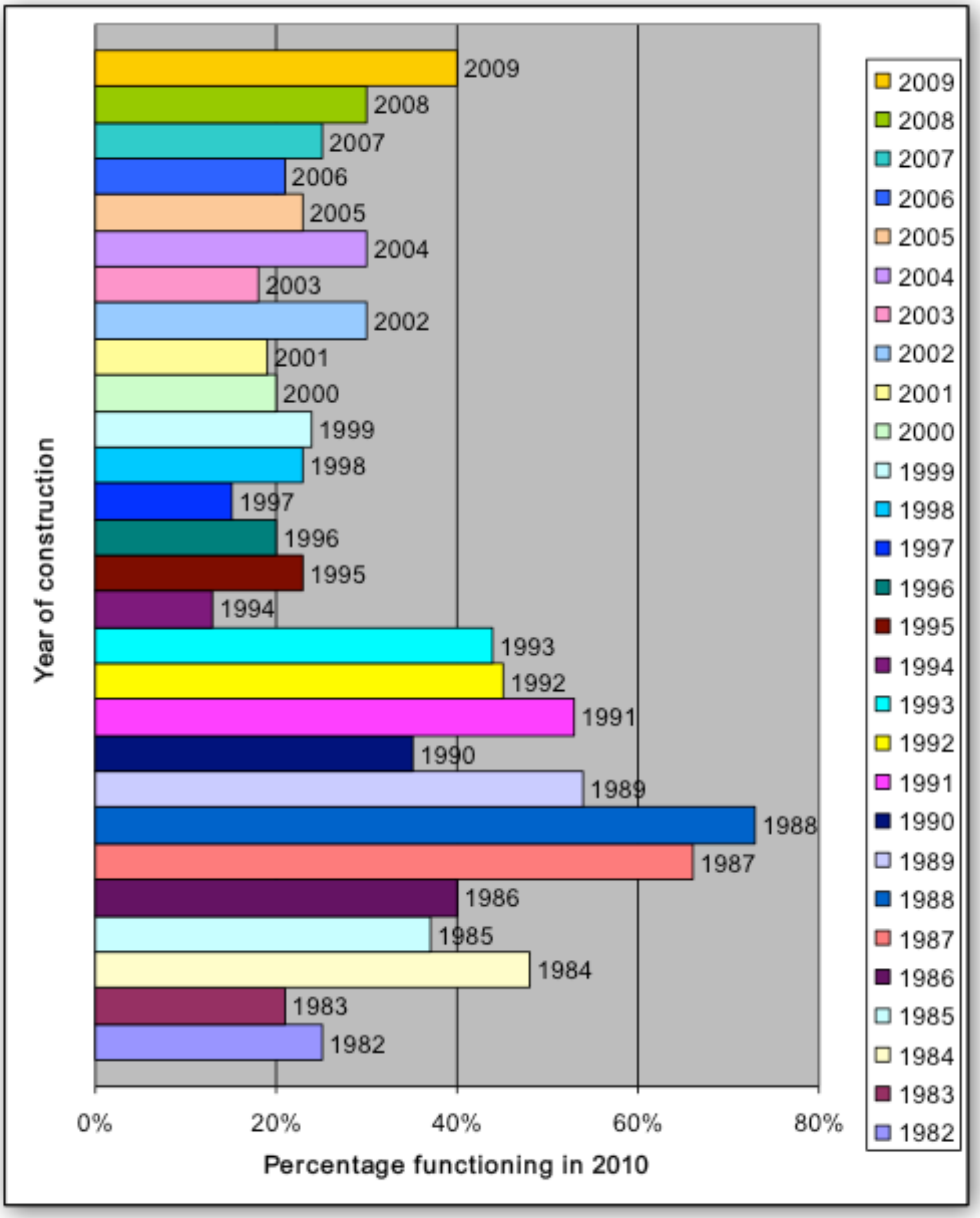

Figure 17: Functionality of systems per year of construction at the time of the survey

IV. DISCUSSION

Access to safe drinking water in Africa is widely known as an area of concern and one that many development practitioners claim as a priority. Examples of accurate documentation of the realities on the ground, however, are practically non-existent. Publications on the topic of drinking water in Africa, especially within the last decade, focus almost exclusively on sample studies related to quality issues with a few articles on technical methodologies or sociological factors. **The dearth of information** in this area at national levels is especially apparent; certainly it is the case for Sierra Leone.

By documenting all existing water access points over a large proportion of national territory, this survey also aims to suggest a replicable template. No other survey covering both technical and sociological aspects and mapping them over a period of decades seems to exist, assertion which the foundation would be glad to see challenged. Can it, given its scope and depth, be considered as broadly representative of the situation well beyond its range is an intriguing question?[8] The assessment by fellow professionals of the reliability of its methodology and approach will largely determine the answer.

Alarming though it is, the fact that more than half of the villages do not have access to safe drinking water is consistent with United Nations' estimates[9] and therefore comes as no great surprise. On the contrary, the extraordinarily **low rates of functionality** for existing water access structures is quite surprising. Added to this are anomalies in the distribution of access points in rural areas. For example, Koinadugu is the district with the lowest number of villages with access (35%) but paradoxically the average number of structures per village is the highest (2.5 systems per village). It is also the district with the most recent construction and the imbalance seems to reflect well-construction campaigns governed by a supply-dominated logic and a lack of planning and coordination which favours the most populated and most easily accessible villages and results in duplication. Throughout the three districts, 8% of the villages with access to safe water have anywhere from 5 to 24 systems. One village of 45 people, for example, has 6 systems.

While the number of open wells (12%) may not be surprising in itself, the fact that the majority of these were constructed in the last decade is difficult to understand since these structures are commonly known to be unsafe in the long-term.

More than one-quarter of the structures in place were either missing a pump or had a pump that did not function. Such an important rate of failure for this crucial element of the water access point can be attributed to a lack of preventive maintenance and technical know-how and to a **disorganized and inadequate market for pumps and spare parts in Sierra Leone**. The former is connected to the drop in management criteria over time. The latter is because no standard for pumps has been developed either by the government or the main providers. Having such a wide variety of pumps in use and therefore increasing the number of distribution channels necessary for spare parts constitutes a major – almost insurmountable – constraint for implementing cost-effective maintenance chains. Communities should be able to obtain supplies at least at the district level which is far from the case in the surveyed region. **This lack of setting and implementing a standard for pumps indicates the inadequate importance attached by all players in the area of water** to a consideration that is nevertheless absolutely key to the sustainability of the systems and therefore to the return on investment of the structures.

The very significant numbers of structures that dry out for part of the year – 26% of all identified systems and 45% of all functioning systems – indicate **the providers' level of technical know-how and/or willingness to comply with basic quality standard**s. Drying can be due to the fact that the pumping system does not draw deeply enough or that the well or borehole itself has not been dug deeply enough. This is typically the case of structures dug outside of the low water level period, so the bottom of the column dries up with the movement of the water table during the dry season.

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[8] - Recently, results of similar studies carried out by Inter Aide in the neighboring district of Bombali coincide with those found in this survey.

[9] - http://www.un.org/millenniumgoals/pdf/MDG_FS_7_EN.pdf

In a separate survey conducted by Inter Aide in the neighbouring district of Bombali between May 2007 and June 2009, seasonal fluctuations in the water column of nearly five metres were mapped and the window for appropriate well sinking was identified.

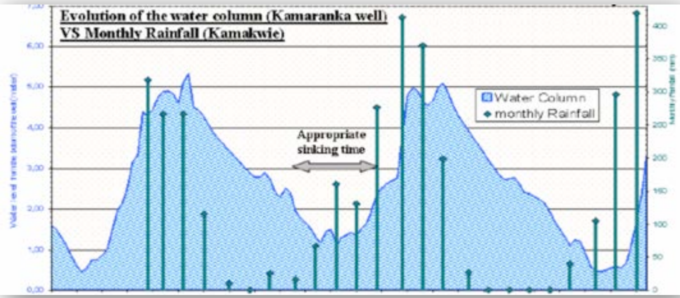

Figure 18a: Evolution of the water column (Kamaranka well)

This relatively short period falls between the months of March and the end of June. Since timing the sinking of a well to correspond to low aquifer levels is basic knowledge and should be standard practice, and since recuperating systems that have been constructed at inappropriate times is either extremely difficult or impossible, the high rates of seasonal drying point either to a poorly managed operational timetable, dictated by supply and "pressure-to-build-quickly" mentality or to a lack of rigour in drawing up precise specification requirements for the construction contractors, a lack of supervision and proper acceptance of the works by the commissioning bodies, and a failure to impose penalties for faulty construction.

Seasonality problems due mainly to errors of design, execution and acceptance of works and caused by a lack of knowledge or by a failure to take into account variations in groundwater represent enormous financial and material loss. Not only do the structures not deliver water in the months when it is most critical for users, but it is usually impossible to repair such defects in construction and completely new systems are required to guarantee year-round water delivery.

One of the most surprising of the survey's findings is evidence that **the older water access points function much better than newer ones**. Although this is explained in part by the fact that boreholes, which have higher rates of water delivery for longer periods of time,[10] are more prevalent among the older structures, factors such as **quality of construction and the presence of management** criteria also influence this result. Fulfilment of management criteria requires support and training once a system is built and constitutes a human or "soft" deliverable which is easy to overlook, difficult to measure and implement, and very often undervalued in the extreme. Still, when one considers that on the day of the survey 73% of the 22-year old systems were working as opposed to 40% of the one-year old systems, the urgent need to **re-evaluate current practices** is glaringly obvious.

The **decline in the fulfilment of management criteria** over time is most likely due to the fact that during the civil war emergency operators moved into the different districts en masse with an approach focused on meeting immediate needs and in a context that was not conducive to ensuring quality or considering middle or longer term realities.

Figure 18b: Evolution of the water column (Kamaranka well)

10 The survey showed that out of 100 boreholes, 83 produce water permanently for an average time span of 19 years per system; out of 100 hand dug wells, 45 produce water permanently for an average time span of 8.5 years.

Unfortunately, **this donor-induced emergency approach seems to have remained even after the conflict ended and stability was restored**. Not surprisingly, it was often the same providers who worked on post-emergency logics, which continued to be driven more by supply than by demand. This supply driven dynamic is further supported by the fact that almost all of the unfinished construction of systems appears post-conflict.

There are no doubt real challenges to switching from a supply-driven approach and operating with more rational and efficient standards. Above and beyond the technical issues, it involves socio-organizational and politico-institutional aspects of effective and sustainable management of the infrastructure. This, in turn, requires longer-term planning and sustained commitments. Stimulating demand, fostering true community ownership of access to safe water, developing local technical expertise, streamlining supply and distribution channels for spare parts are all essential ingredients for ensuring return on investment and durability of the systems. Difficult though this may seem to achieve, this study reveals that it is not impossible since it has been done in the past. It also demonstrates clearly that the alternative results in sure and egregious waste – in spite of good intentions and goals for improvement – leaving countless people in desperate need of the most basic of life’s necessities.

ANNEX I

Basic features of water access point structures identified in the survey:

1. **Hand-dug well:** this age-old technique is relatively simple but needs strict compliance with certain principles to ensure sustainability. It is done in four stages (see diagram on next page):

    1.1. **dry digging and lining:** this corresponds to the sinking of the "dry column" of the well from the surface to the water table. Lining protects this column to prevent the walls from collapsing (it can be executed in concrete or brickwork);

    1.2. **casing – casing column:** once the water table has been reached and the lining completed, the construction of the casing column is carried out by means of filtering nozzles then sinking of the water table by digging at the centre of the casing column which will "slide" inside the well and go down into the water table to form the aquifer intake zone.

    1.3. **surface installations:** will depend on the choice of the pump

    1.4. **pump installation:** the choice of the pump is of strategic importance and must be made as a function of factors such as currently-valid national standards, presence of spare parts supply chains, ease of being repaired locally, purchase and implementation costs and the users' financial capacity.

Main advantages of a hand-dug well:

- can be dug in enclosed areas (difficult to reach with drilling trucks);
- makes use of local labour with simple and reproducible techniques;
- provides focal point to mobilize communities around a project;
- easily maintained, chlorinated, etc., by local craftsmen or committees;

2. **Borehole:** is executed by means of a mobile drill, generally mounted on a heavy truck and powered by a diesel motor. Once the ground water has been reached, the drilling column is lined and cased in its lower part (casing column); the intake part of the borehole is then developed, using a compressor to blast air down the hole to clear the intake region and prevent the risks of clogging. Boreholes require sophisticated, costly and large equipment as well as the access needed to operate. In the event of a problem, maintenance also requires specialised, costly equipment.

    Main advantages of a borehole:

    - allows deeper aquifers to be reached;
    - can go through rocky strata;
    - is quickly implemented.

3. **Open well:** open wells which are unlined and unprotected are equipped with a pulley system for water retrieval. They involve higher risks of contamination and are not regarded as suitable systems for guaranteeing drinking water in the long term.

4. **Spring box:** this involves capturing a spring as it emerges from the ground, protecting it from outside contamination and surface water and then transporting the water, generally by the force of gravity. For properly executed spring boxes, it is a relatively sustainable system requiring little maintenance. Due to prevailing topography in Sierra Leone, with relatively minimum gradient changes, this technique is rarely appropriate.